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Woo

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(54) **PRINTING MEDIUM SUPPLYING APPARATUS AND IMAGE FORMING APPARATUS HAVING THE SAME**

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B65H 3/06 (2006.01)

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CPC ***B65H 1/04*** (2013.01); ***B65H 3/0607*** (2013.01); *B65H 2402/64* (2013.01); *B65H 2403/5331* (2013.01); *B65H 2405/1117* (2013.01); *B65H 2405/324* (2013.01); *B65H 2601/322* (2013.01); *B65H 2801/06* (2013.01)

(58) **Field of Classification Search**
CPC B65H 1/04; B65H 3/0661; B65H 2402/31; B65H 2405/11162; B65H 2405/1117; B65H 2405/324; B65H 3/0607; B65H 2403/5331; B65H 2402/64; B65H 2601/322; B65H 2801/06
USPC 271/127, 162
See application file for complete search history.

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(57) **ABSTRACT**

A printing medium supplying apparatus may include a body, a feed tray configured to rotate between a first position in which the feed tray forms an external appearance of the body and a second position in which a printing medium is loaded, a knock-up plate provided on the feed tray configured to ascend and descend, a pickup roller configured to make contact with the loaded printing medium as the knock-up plate ascends, and a rotating lever configured to allow the knock-up plate to be restricted at a side of the feed tray when the feed tray rotates from the first position to the second position. Accordingly, the knock-up plate are restricted and released together with operations of the pickup roller and the feed tray.

20 Claims, 8 Drawing Sheets

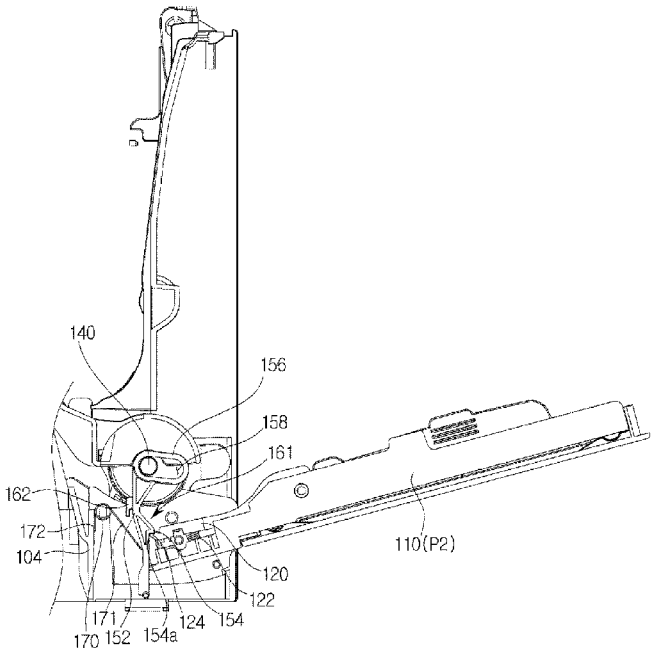


FIG. 1

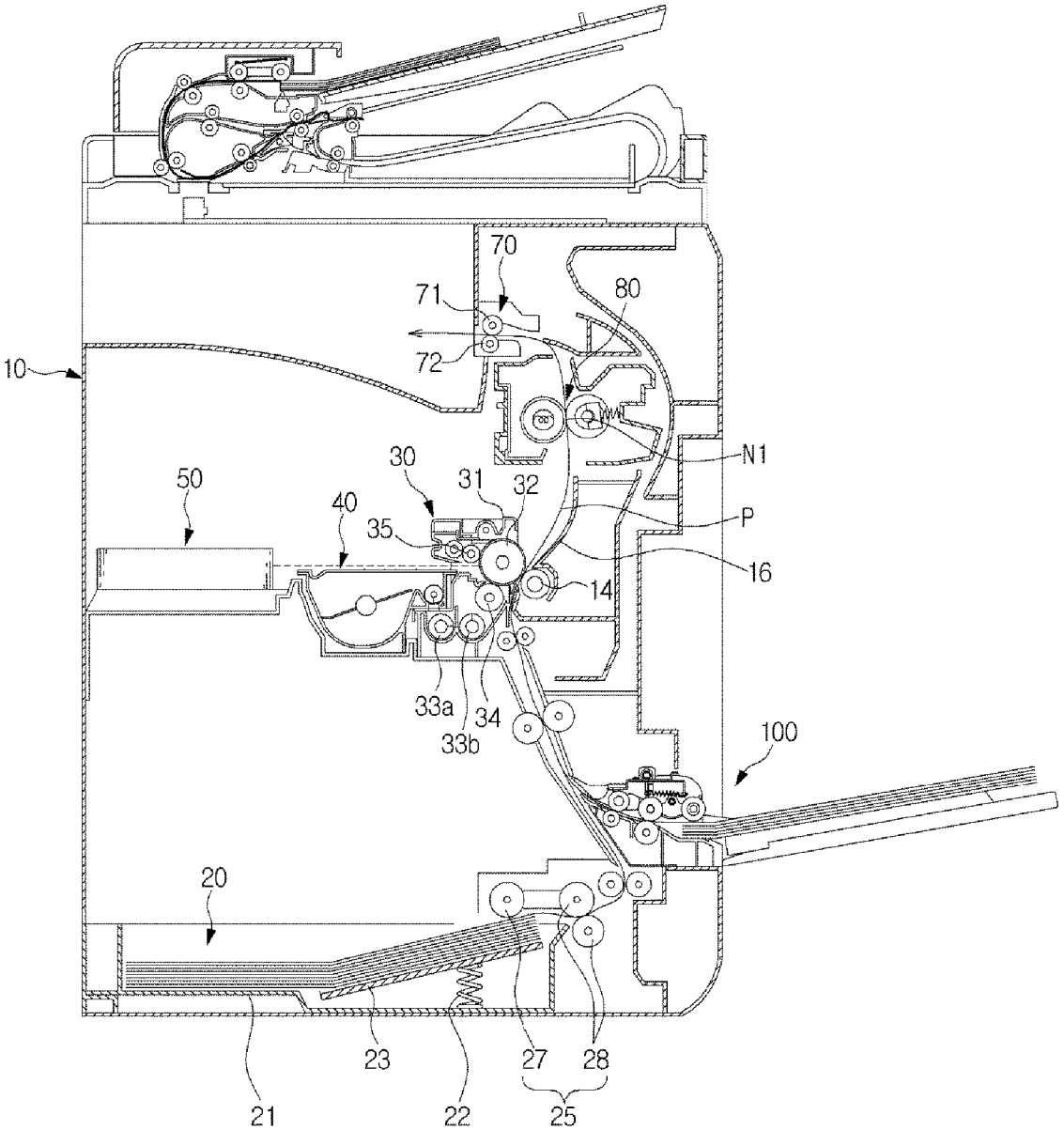

70
71
80
72
10
N1
30
31
32
50
40
35
P
16
14
33a
34
33b
100
20
23
27
28
21
22
25

FIG. 2

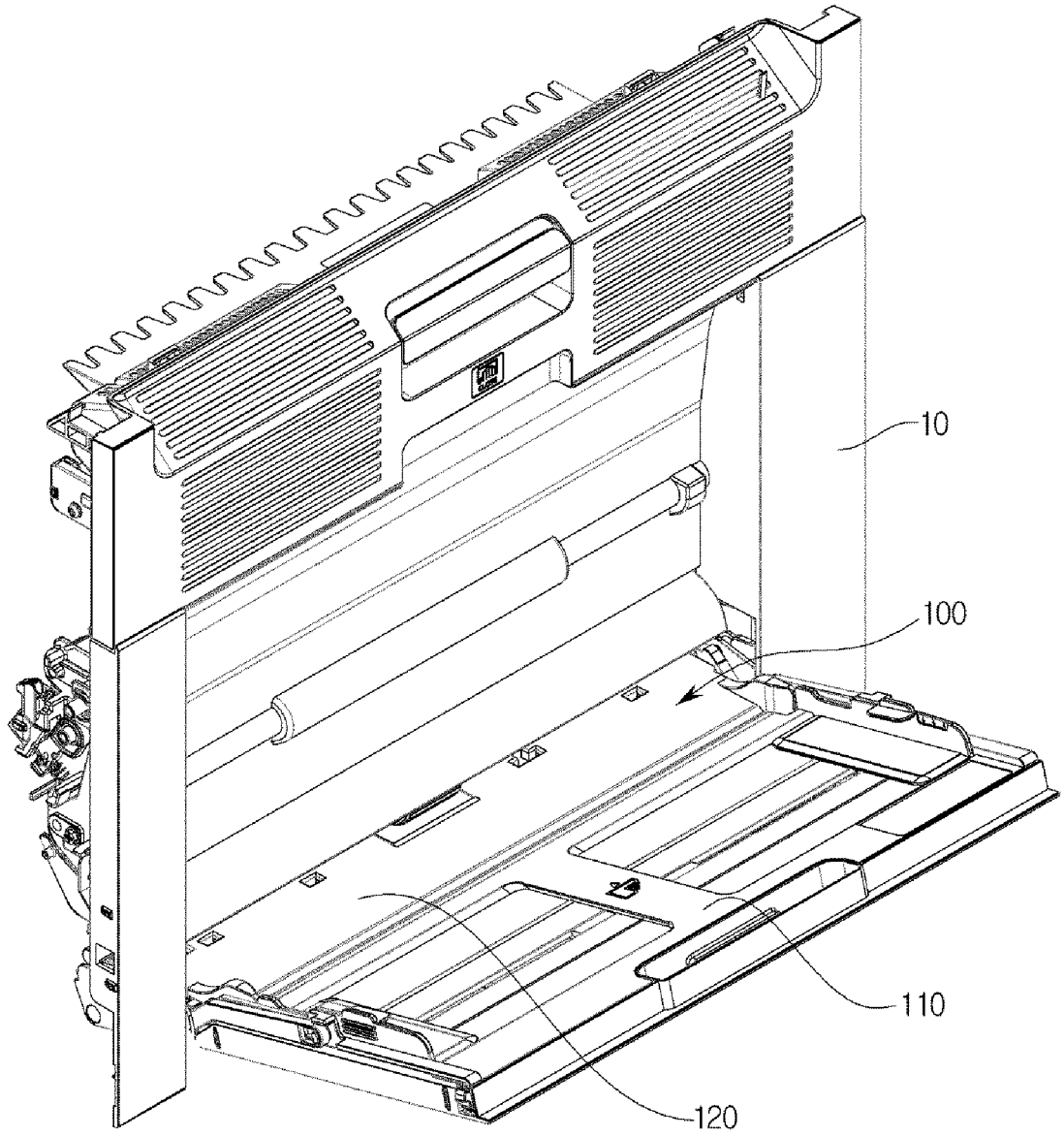


FIG. 3

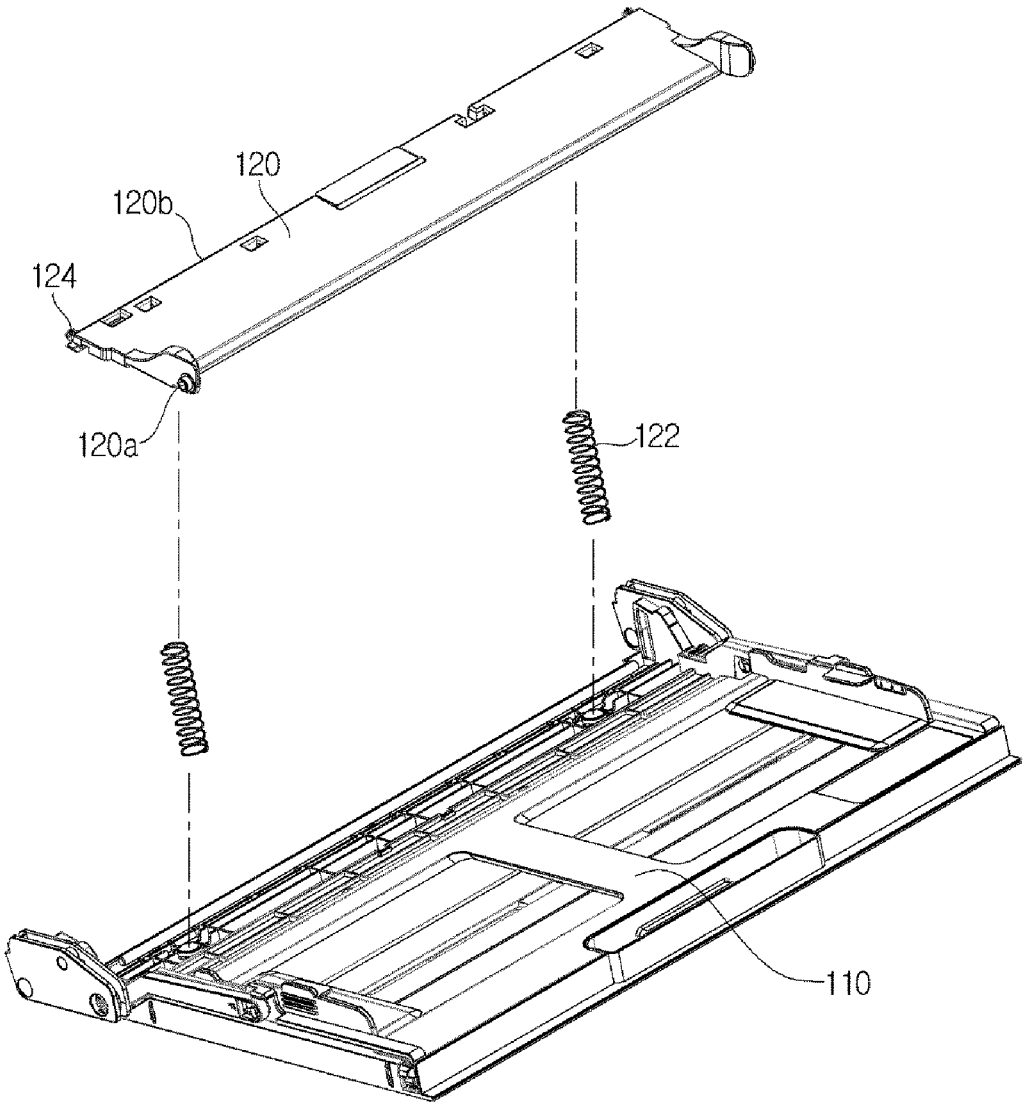


FIG. 4

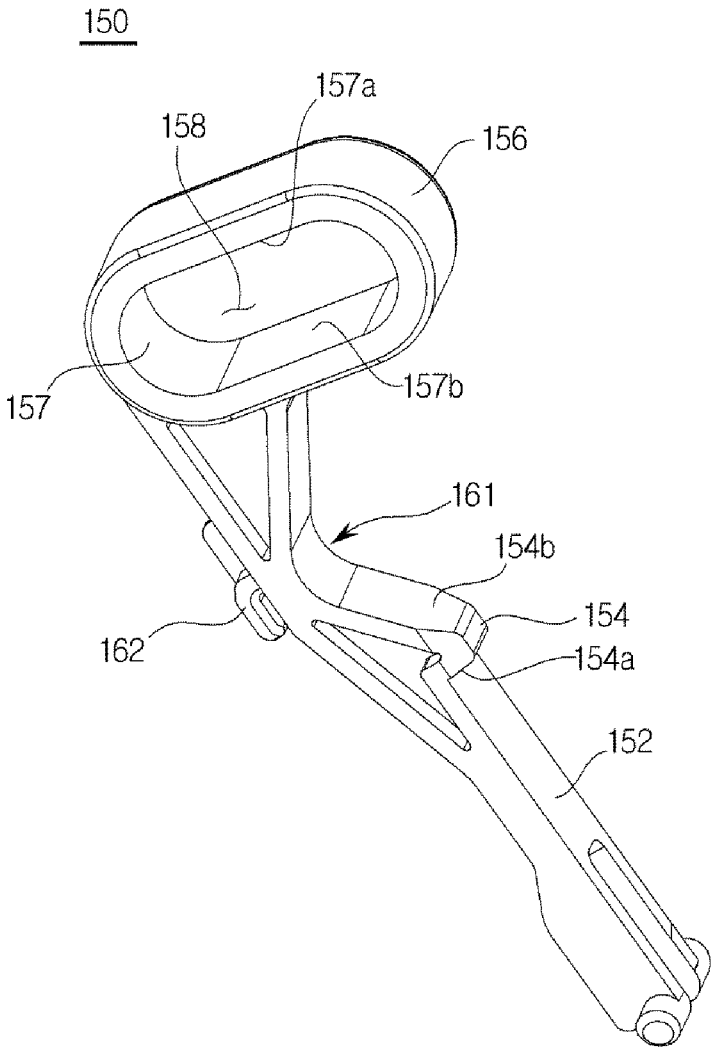


FIG. 5

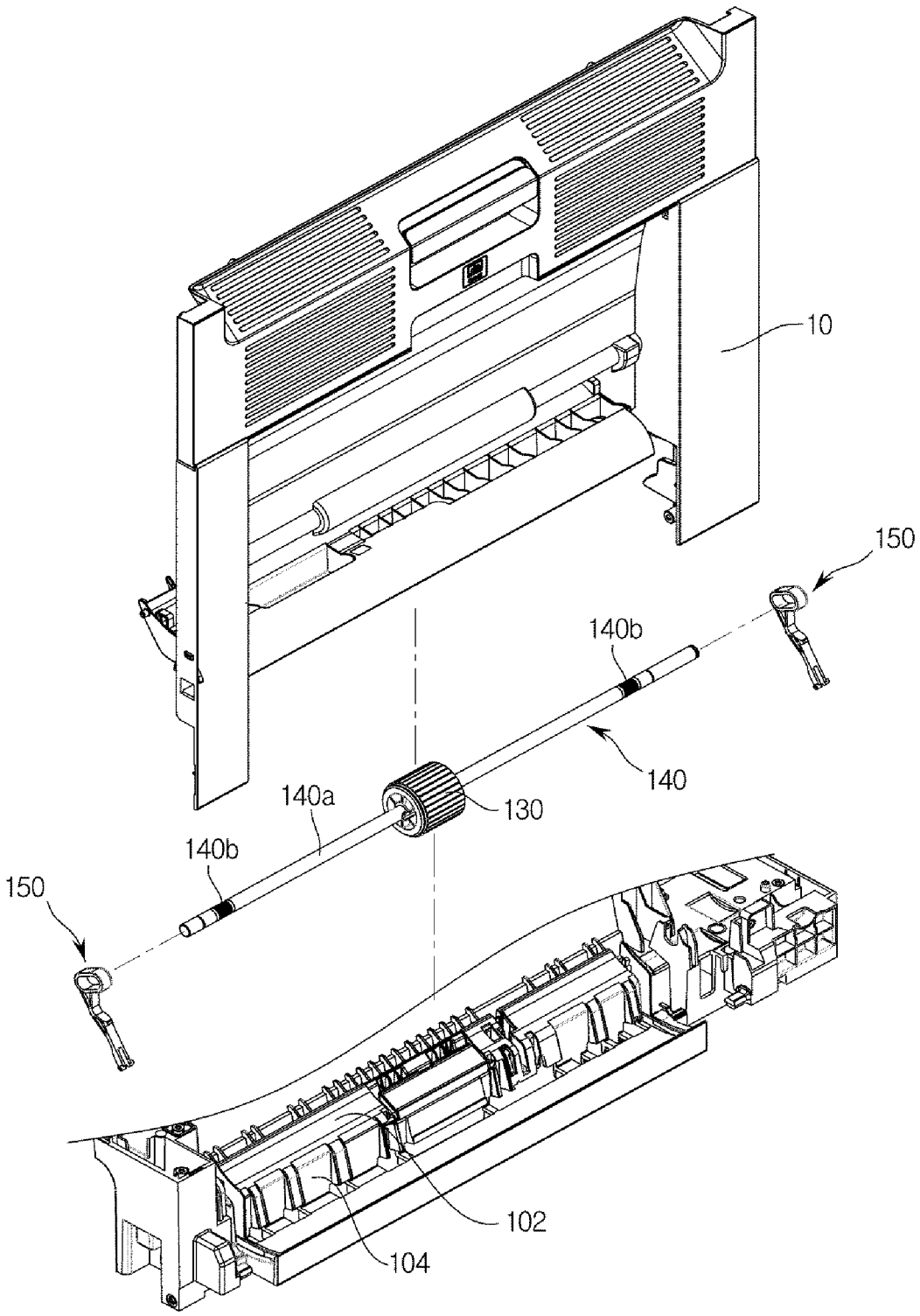


FIG. 6

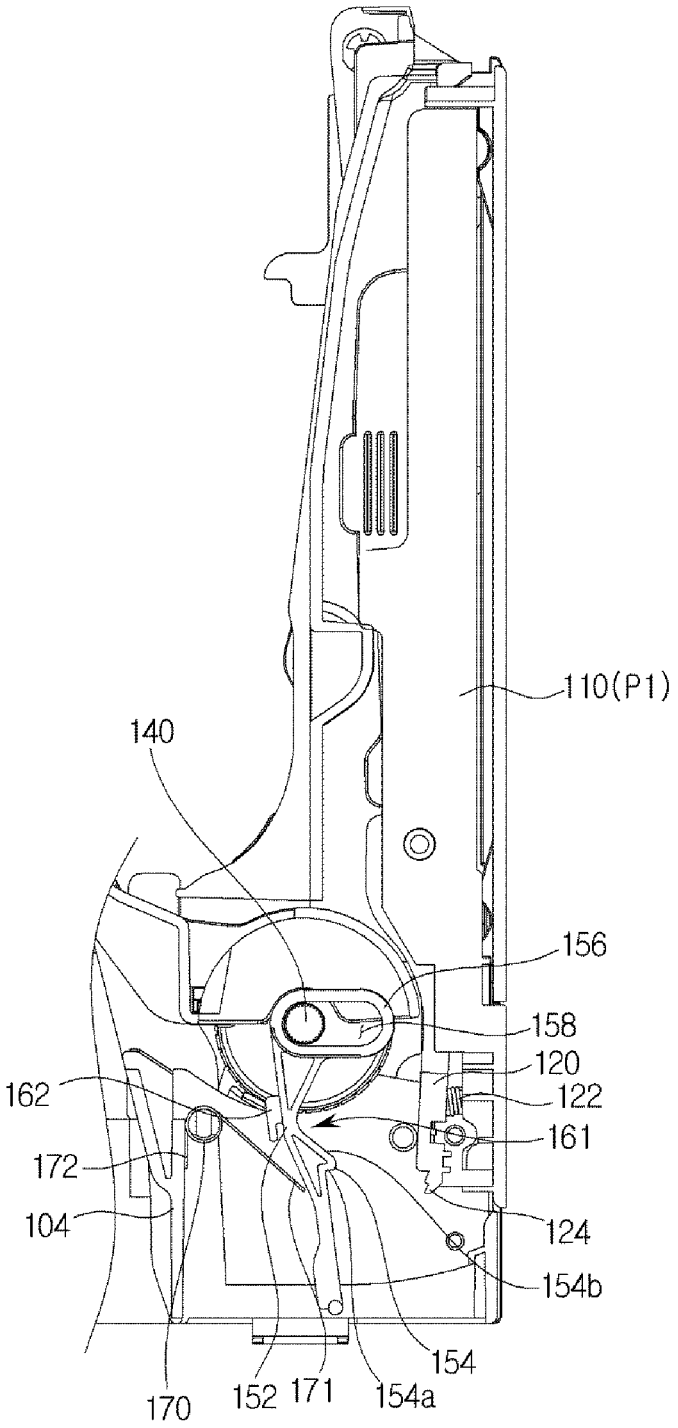

110(P1)
140
156
158
120
122
162
161
172
104
124
154b
154
170
152
171
154a

FIG. 7

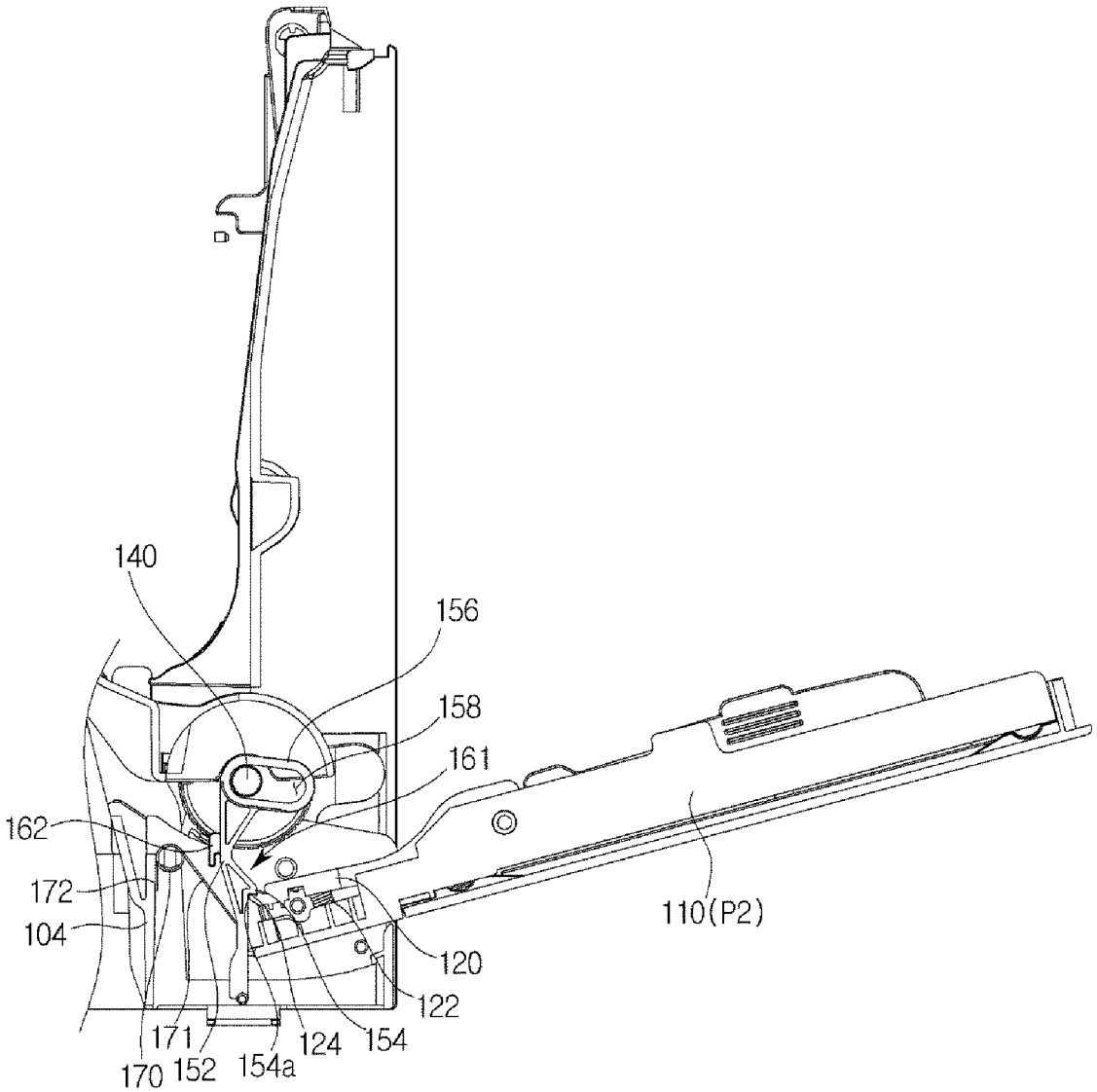
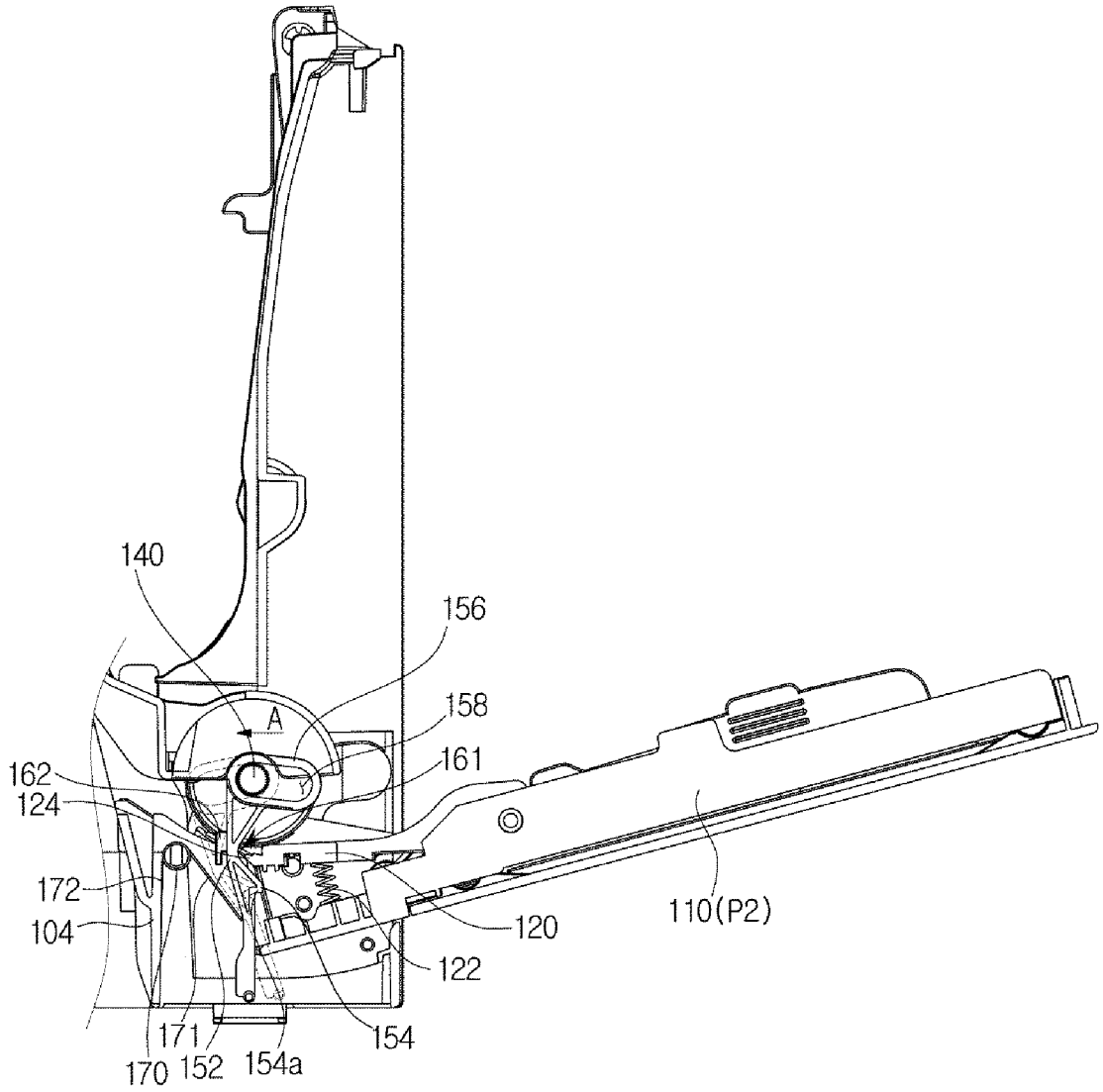

140
156
158
161
162
172
104
110(P2)
120
122
171
170
152
154a
124
154

FIG. 8


140
156
158
A
161
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124
172
104
120
110(P2)
122
171
170
152
154a
154

PRINTING MEDIUM SUPPLYING APPARATUS AND IMAGE FORMING APPARATUS HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Korean Patent Application No. 10-2013-0105672, filed on Sep. 3, 2013, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments of the present disclosure relate to a printing medium supplying apparatus and an image forming apparatus having the same, and more particularly, to a printing medium supplying apparatus having an improved structure for facilitating supply of printing medium and an image forming apparatus having the same.

2. Description of the Related Art

An image forming apparatus is designed to form an image on a printing medium according to an input signal. Examples of the image forming apparatus include a printer, a copier, a facsimile and a multi-function device combining functions of the above-mentioned appliances.

The image forming apparatus is provided with a printing medium supplying apparatus for supplying printing medium. In general, the printing medium supplying apparatus picks up stacked printing media one by one and supplies the printing medium to a body of the image forming apparatus.

The printing medium supplying apparatus includes a feed tray configured to store a plurality of sheets of printing media that are to be fed to an image forming part, and a knock-up plate is provided on the feed tray so as to move up and down.

The knock-up plate is provided to allow the printing medium to be pressed against the pickup roller. As to install the knock-up plate, a user needs to forcedly and directly move the knock-up plate downward and keep pressing the knock-up plate in order to newly load printing medium on the feed tray, which causes inconvenience to a user.

SUMMARY

According to an aspect of one or more embodiments, there is provided a printing medium supplying apparatus having an improved structure for facilitating manipulation of a knock-up plate, and an image forming apparatus having the same.

According to an aspect of one or more embodiments, there is provided an image forming apparatus which may include a body, a feed tray, a knock-up plate, and a rotating lever. The feed tray may be configured to rotate between a first position in which the feed tray forms an external appearance of the body and a second position in which a printing medium is loaded. The knock-up plate may be provided on the feed tray configured to ascend and descend. The pickup roller may be configured to make contact with the loaded printing medium as the knock-up plate ascends. The rotating lever may be configured to allow the knock-up plate to be restricted at a side of the feed tray when the feed tray rotates from the first position to the second position.

The rotating lever may release the restriction of the knock-up plate at the same time when the pickup roller picks up the printing medium.

The rotating lever may include a lever body provided so as to be rotatable; and a locking protrusion which protrudes from the lever body to restrict the knock-up plate from ascending.

The locking protrusion may include a restriction surface that is bent from the lever body to make contact with the knock plate to restrict an ascending side of the knock-up plate.

The locking protrusion may include a guide inclination surface that protrudes so as to be inclined with respect to a length direction extending from a rotating center of the lever body such that the knock-up plate is restricted by the restriction surface.

The knock-up plate may be provided on a downstream side in a feeding direction of the printing medium being fed by the feed tray.

The knock-up plate may include: a plate rotating part provided on an upstream side in a feeding direction of the printing medium and allowing the knock-up plate to be rotated; and a plate lifting part provided on a downstream side in a feeding direction of the printing medium and configured to ascend and descend.

The knock-up plate may further include a holding protrusion that protrudes from the plate lifting part so as to be restricted by the rotating lever.

The image forming apparatus may further include a lever elastic member configured to press the lever body toward the knock-up plate.

The rotating lever may further include a mounting protrusion to mount one end of the lever elastic member pressing the lever body thereon.

The rotating lever may further include a lever rotating part provided at an end portion of the lever body to rotate the lever body and configured to operate with rotation of the pickup roller.

The image forming apparatus may further include a shaft coupled to the pickup roller, wherein the lever rotating part may be provided with an elliptical hollow part allowing the shaft to pass therethrough.

The lever rotating part may include an inner surface forming an elliptical hollow part, and the rotating lever may be rotated by friction made between the inner surface of the lever rotating part and an outer surface of the shaft.

The hollow part may be provided in an elliptical shape such that the rotating lever moves in a direction perpendicular to a lengthwise direction of the shaft.

The shaft may include: a first section to which the pickup roller is coupled and which is passed by the printing medium, and second sections which are provided at both sides of the first section and on which the rotating lever is disposed.

The second sections may be provided with a plurality of protrusions formed along a circumference of the shaft to increase friction with the inner surface of the lever rotating part.

According to an aspect of one or more embodiments, there is provided a printing medium supplying apparatus which may include a feed tray, a pickup roller, a knock-up plate and a rotating lever. The feed tray may allow a printing medium to be loaded thereon. The pickup roller may be configured to pick up the loaded printing medium. The knock-up plate may be provided on the feed tray so as to ascend and descend to allow the printing medium to make contact with the pickup roller. The rotating lever may be configured to allow the knock-up plate to be restricted at a side of the feed tray, the rotating lever configured to release the restriction of the knock plate by being spaced apart from the knock-up plate when the pickup roller picks up the printing medium.

The rotating lever may include: a lever body provided in an elongated shape; a lever rotating part provided at an end portion of the lever body and configured to operate with rotation of the pickup roller such that the lever body is moved; and a locking protrusion which protrudes from the lever body to press the knock-up plate toward the feed tray.

The printing medium supplying apparatus may further include a lever elastic member configured to press the rotating lever toward the knock-up plate.

If a force applied to the rotating lever by the lever elastic member is a first pressing force F1 and a force applied to the rotating lever in linkage with rotation of the pickup roller is a second pressing force F2, and the second pressing force F2 may be greater than the first pressing force F1 when the pickup roller operates.

The knock-up plate may include a first state in which the knock plate descends to make contact with the feed tray, and a second state in which the knock-up plate ascends to be spaced apart from the feed tray, and the knock-up plate may operate from the first state to the second as the rotating lever is spaced apart from the knock-up plate due to rotation of the pickup roller

As is apparent from the above, the printing medium supplying apparatus and the image forming apparatus having the same can facilitate supplying the printing medium and allow the knock-plate to be pressed toward the pickup roller upon supplying the printing medium by improving the elevation structure of the knock-up plate.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of the disclosure will become apparent and more readily appreciated from the following description of embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a view illustrating an image forming apparatus in accordance with an embodiment of the present disclosure.

FIG. **2** is a view illustrating a feed tray of the image forming apparatus in accordance with an embodiment of the present disclosure which is open.

FIG. **3** is an exploded perspective view illustrating a feed tray and a knock-up tray in accordance with an embodiment of the present disclosure.

FIG. **4** is an exploded perspective view illustrating a pickup roller and a rotating lever in accordance with an embodiment of the present disclosure.

FIG. **5** is a perspective view illustrating a rotating lever in accordance with an embodiment of the present disclosure.

FIGS. **6**, **7** and **8** are drawings illustrating an operation of an image forming apparatus according an embodiment of the present disclosure.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. **1** is a view illustrating an image forming apparatus in accordance with an embodiment of the present disclosure.

Referring to FIG. **1**, an image forming apparatus **1** includes a body **10**, printing medium supplying apparatuses **20** and **100** to store and feed printing media S, a developing device **30** to form an image on the printing medium S fed through the printing medium supplying apparatuses **20** and **100**, a toner device **40** to feed toner to the developing device **30**, an optical scanning device **50** to form an electrostatic latent image on a photosensitive body **32** of the developing device **30**, a fusing device **80** to fix a tonner image transferred to the printing medium S to the printing media S, and a discharge device **70** to discharge the printing medium S having an image formed thereon to the outside of the body **10**.

The printing medium supplying apparatus **20** serves store and feed the printing medium S and provided at a lower side of the body **10** to feed the printing medium S toward the developing device **30**.

The printing medium supplying apparatus **20** includes a cassette-type feed part **21** retractably placed in the body **10** to store the printing medium S, and a transport member **25** to pick up the printing media S stored in the feed part **21** one by one and transport the same toward the developing device **30**.

A knock-up plate **23** may be provided in the feed part **21**. One end of the knock-up plate **23** is rotatably coupled, and the other end thereof is supported by a compression spring **22** to transport the stacked printing media S toward the transport member **25**.

The transport member **25** includes a pickup roller **27** to pick up the printing medium S stacked on the knock-up plate **23** one by one, and a feed roller **28** to transport the printing medium S picked up by the pick-up roller **27** toward the developing device **30**.

The developing device **30** includes a housing **31** forming an external appearance thereof, a photosensitive body **32** rotatably coupled to the inside of the housing **31** to form an electrostatic latent image, churning screws **33***a* and **33***b* to churn the toner fed from the toner device **40**, a developing roller **34** to feed the toner churned by the churning screws **33***a* and **33***b* to the photosensitive body **32**, and a charging member **35** to charge the photosensitive body **32**.

The toner from the toner device **40** is introduced into the housing **31**, churned by the churning screws **33***a* and **33***b* and transported to one side of the housing **31**. The churned and transported toner is fed to the photosensitive body **32** by the developing roller **34** to form a visible image.

To transfer the visible image formed on the photosensitive body **32** by the toner to the printing medium S, the photosensitive body **32** contacts the transfer roller **14** and forms a transfer nip N1. The transfer roller **14** is rotatably disposed in the body **10**.

The toner device **40** is coupled to the developing device **30** and adapted to accommodate and retain the toner to form an image on a printing media S and to feed the toner to the developing device **30** as image formation proceeds

The optical scanning device **50** emits light including information about an image onto the photosensitive body **32** to form an electrostatic latent image on the photosensitive body **32**.

The fusing device **80** applies heat and pressure to the printing medium S to fix the toner image formed on the printing medium S to the printing medium S. A detailed description of the structure of the fusing device **80** will be given later.

The discharge device **70** includes a first paper discharge roller **71** and a second paper discharge roller **72**, which are sequentially installed, and discharge the printing medium S leaving the fusing device **100** to the outside of the body **10**.

Disposed between the transfer nip N1 and the fusing device **80** is a guide rib **16** to guide the printing medium S leaving the transfer nip N1 to the fusing device **80**. The guide rib **16** forms a portion of a transport path P of the printing medium S between the transfer nip N1 and the fusing device **80**.

FIG. **2** is a view illustrating a feed tray in accordance with an embodiment of the present disclosure which is open, FIG. **3** is an exploded perspective view illustrating a feed tray and a knock-up tray in accordance with an embodiment of the

present disclosure, FIG. **4** is an exploded perspective view illustrating a pickup roller and a rotating lever in accordance with an embodiment of the present disclosure, and FIG. **5** is a perspective view illustrating a rotating lever in accordance with an embodiment of the present disclosure.

Although the following description according to an embodiment of the present application will be made in relation to the printing medium supply apparatus **100** having a feed tray rotatable with respect to the body **10**, the present disclosure is not limited thereto. For example, the present application may be applied to a printing medium supplying apparatus having a cassette-type feed tray **110** provided in the body **10**.

The printing medium supplying apparatus **100** serves to supply printing medium to an element configured to form an image, for example, to the developing device **30** described above.

The printing medium supplying apparatus **100** may include a feed tray **110**, a pickup roller **130**, a knock-up plate **120** and a rotating lever **150**.

The feed tray **110** is detachably provided on the body **10**, and is rotatably provided to open and close the body **10**.

In detail, the feed tray **110** is rotatable between a first position P1 in which the feed tray **110** is folded to one surface of the body **10** to form an external appearance of the body **10** and a second position P2 in which the feed tray **110** is open such that the printing medium S is loaded on the feed tray **110**. A path W, allowing the printing medium S having been stacked on the feed tray **110** to be introduced into the body **10** by passing therethrough is provided to be closed when the feed tray **110** is at the first position P1, and open when the feed tray **110** is at the second position P2.

The pickup roller **130** is disposed on an upper portion of a front end in a feeding direction of printing medium S stacked on the feed tray **110**. According to rotation of the pickup roller **130**, the plurality of sheets of printing media S stacked on the feed tray **110** are picked up one by one starting from that the upper most printing medium S among the plurality of sheets of printing media S.

A printing medium guide surface **102** is provided on a lower side of the pickup roller **130** to guide and feed the printing medium S picked up by the pickup roller **130** to the image forming part inside the body **10**. The printing medium S is guided by the printing medium guide surface **102**, and by passing through a feed roller (not shown), is fed to the developing device **30**.

The pickup roller **130** is coupled to a shaft **140** so as to be rotated together with rotation of the shaft **140**. One end portion of the shaft **40** is coupled to a motor (not shown) and a plurality of gears (not shown) to receive a power, thereby rotating the pickup roller **130**.

The shaft **140** includes a first section **140***a* to which the pickup roller **130** is coupled to the shaft **140** and is passed by the printing medium S, and second sections **140***b* provided at both sides of the first section **140***a* and on which the rotating lever **150** is disposed. The second sections **140***b* are disposed at both end sides of the knock-up plate **120**, such that the rotating lever **150** restricts both end portions of the knock-up plate **120**.

The second sections **140***b* may be provided with a plurality of protrusions formed along the circumference of the shaft **140** to increase friction with respect to a lever rotating part **156** of the rotating lever **150**, which will be described later. The number and length of the second sections **140***b* are not limited thereto. According to an embodiment of the present disclosure, a total of two second sections **140***b* is provided while corresponding to both end sides of the knock-up late **120**, and each of the second sections **140***b* has a length corresponding to a thickness of the rotating lever **150**. The cross sectional shape of the second sections **140***b* is not limited as long as it increases the friction with respect to the lever rotating part **156**.

A holder pad **132** may be provided at a lower side of the pickup roller **130**. The printing medium S is provided to pass through in between the pickup roller **130** and the holder pad **132**. The holder pad **132** is provided to allow the printing media S to pass in between the holder pad **132** and the pickup roller **130** one by one. The frictional force formed by the pickup roller **130** and the printing medium S is provided to be smaller than that formed between the holder pad **132** and the printing medium, so that the printing medium S is delivered only by the pickup roller **130** even when a plurality of sheets of printing media S are introduced.

The knock-up plate **120** may be provided on the feed tray **110**. The knock-up plate **120** is provided on an upper side of the feed tray **110** so as to ascend and descend with respect to the feed tray **110** to press the printing medium stacked on the feed tray **110** toward the pickup roller **130**. In detail, the knock-up plate **120** is provided on a downstream side in a feeding direction of the printing medium S on the feed tray **110**, to raise the stacked printing medium to be pressed toward the pickup roller **130**.

A plate elastic member **122** is provided between the feed tray **110** and the knock-up plate **120** to apply an elastic force such that the knock-up plate **120** ascends from the feed tray **110**.

The knock-up plate **120** has a first state in which the knock-up plate comes into close contact with the feed tray **110** by descending and a second state in which the knock-up plate is spaced apart from the fed tray **110** by ascending.

The knock-up plate **120** includes a plate rotating part **120***a* and a plate lifting part **120***b*. The plate rotating part **120***a* is provided on an upstream side in a feeding direction of the printing medium S and allows the knock-up plate **120** to be rotated. The plate lifting part **120***b* is provided on a lower stream side in a feeding direction of the printing medium S and moves up and down. The first state and the second state correspond to descending and ascending of the plate lifting part **120***b*, respectively.

The knock-up plate **120** further includes a locking protrusion **124** that protrudes from the plate lifting part **120***b* so as to correspond to a holding protrusion **154** of the rotating lever **150** that will be described later.

The locking protrusion **124** is provided at an ascending end portion of the knock-up plate **120** on the downstream side in the delivery direction of the printing medium S so as to be restricted by the holding protrusion **154** of the rotating lever **150** which will be described later. As the locking protrusion **124** is pressed by the holding protrusion **154**, the knock-up plate **120** is limited on the motion thereof such that the knock-up plate **120** comes into close contact with the feed tray **110**.

The rotating lever **150** is configured to selectively restrict the knock plate **120**.

The rotating lever **150** restricts the knock-up plate **120** such that the printing medium is loaded thereon, or allow the knock-up plate **120** to ascend during a pickup operation of the pickup roller **130**.

The rotating lever **150** may be provided such that the knock-up plate **120** is restricted at a side of the feed tray **110** when the feed tray **110** rotates from the first position P1 to the second position P2. The allowing of the knock up plate **120** to be restricted at a side of the feed tray **110** using the rotating lever **150** may be achieved in various methods. In a first example, the knock-up plate **120** may be locked with the

rotating lever **150** as the feed tray **110** is rotated from the first position P1 to the second position P2. In a second example, the knock plate **120** may be locked with the rotating lever **150** as the knock-up plate **120** is given a pressing force to come into close contact with the feed tray **100**. However, the method of allowing the knock-up plate **120** to be restricted at a side of the feed tray **110** is not limited thereto.

The rotating lever **150** operates in linkage with the pickup roller **130** and the shaft **140** that operates together with the pickup roller **130**. The restriction of the knock-up plate **120** is released by rotations of the pickup roller **130** and the shaft **140** according to a pickup operation of the pickup roller **130**. In other words, the rotating lever **150** is spaced apart from the knock-up plate **120** upon a pick-up operation of the pickup roller **130**, thereby releasing the restriction of the knock-up plate **120**.

The rotating lever **150** may include a lever body **152** and the holding protrusion **154**.

The lever body **152** is rotatably provided, and is kept pressed toward the knock-up plate **120** by a lever elastic member **170** which will be described later. The rotating lever **150** rotates in linkage with rotation of the pickup roller **130**. The lever body **152** radially extends from a rotating center thereof, and is configured to come into close contact with the knock-up plate **120**. The lever body **152** may be longitudinally provided in a shape extending from the shaft **140** toward the knock-up plate **120** so as to restrict or release an operation of the knock-up plate **120** in linage with operation of the shaft **140**.

The lever elastic member **170** is configured to press the lever body **152** toward the knock-up plate **120**. One end of the lever elastic member **170** presses the lever body **152**, and the other end of the lever elastic member **170** is supported by a support frame **104** provided on the body **10**. Although the support frame **104** according to an embodiment of the present disclosure is provided on the body **10**, the present disclosure is not limited thereto. For example, the support frame **104** may extend from the feed tray **110**. Although the lever elastic member **170** according to an embodiment of the present disclosure is fixed to a fixing part provided on the body **10**, and includes a first elastic part **171** pressing the rotating lever **150** and a second elastic part **172** supported by the support frame **104**, the shape of the lever elastic member **170** is not limited thereto.

If a force applied to the rotating lever **150** by the lever elastic member **170** is a first pressing force F1 and a force applied to the rotating lever **150** in linkage with rotation of the pickup roller **130** is a second pressing force F2, the second pressing force F2 is greater than the first pressing force F1 when the pickup roller **130** operates, so that the rotating lever **150** is spaced apart from the knock-up plate **1120**.

The holding protrusion **154** protrudes from the lever body **152**, and is configured to press the knock-up plate **120** toward the feed tray **110** such that the knock-up plate **120** is restricted from ascending.

The holding protrusion **154** may include a restriction surface **154***a*. The restriction surface **154***a* is a portion of the holding protrusion **154** making direct contact with the knock-up plate **120**, and represents a surface that is bent from the lever body **152**. The restriction surface **154***a* is provided to face an upper surface of the knock-up plate **120** to limit ascending of the knock-up plate **120**.

The holding protrusion **154** may further include a guide inclination surface **154***b*. The guide inclination surface **154***a* is a surface that protrudes while being inclined with respect to a length direction extending from a rotating center of the lever body **152**. That is, the guide inclination surface **154***a* is a surface that protrudes while being inclined with respect to a length direction extending from one end portion of the lever body **152** adjacent to the shaft **140** to the other end portion of the lever body **152** adjacent to an end of the knock-up plate **120**. When the knock-up plate **120** changes from the first state in which the knock-up plate **120** is lifted from the feed tray **110** to the second state in which the knock-up plate **120** comes into close contact with the feed tray **110**, the knock-up plate **120** may move along the lever body **152**. The guide inclination surface **154***b* has an inclination to guide the end portion of the knock-up plate **120** such that the knock-up plate **120** is restricted by the restriction surface **154***a*.

The rotating lever **150** may further include the lever rotating part **156**. The lever rotating part **156** may be provided such that the rotating lever **150** operates in linkage with rotations of the shaft **140** and the pickup roller **130**. With regard to a pick up operation of the pickup roller **130**, the lever rotating part **156** may move the lever body **152** to be spaced apart from the knock-up late **120**. The movement of the lever body **152** may include at least one of a circular movement or a linear movement.

The lever rotating part **156** may be provided with a hollow part **158** allowing the shaft **140** to pass therethrough. In detail, the hollow part **158** may have an inner surface **157** having the hollow part **158**. The rotating lever **150** is rotated by friction between the inner surface **157** and an outer surface of the shaft **140**.

The lever rotating part **156** according to an embodiment of the present disclosure is provided in an elliptical shape to guide the lever rotating part **156** to perform a linear movement together with a circular movement around the shaft **140**. However, according to another embodiment of the present disclosure, the lever rotating part **156** may be provided in a circular shape.

When the pickup roller **130** and the shaft **140** start rotating, the lever rotating part **156** receives a frictional force that is generated due to the rotation of the pickup roller **130** and the shaft **140** and enough to rotate in the same direction as that of the pickup roller **130** and the shaft **140**. Since the lever body **152** is provided to move apart from the knock-up plate **120** according to rotation of the lever rotating part **156**, even if the lever rotating part **156** is provided in a circular shape to surround the shaft **150**, the lever body **152** moves apart from the knock-up plate **120**. However, the hollow part **158**, which has an elliptical shape (elliptical hollow part **158**), not only provides a rotary force, but also allows the lever body **152** to linearly move apart from the knock-up plate **120** in a direction perpendicular to the lengthwise direction of the shaft **140**, so that the rotating lever **150** is more clearly spaced from the knock-up plate **120**.

The inner surface **157** may include an upper friction surface **157***a* and a lower friction surface **157***b*. The upper friction surface **157***a* and the lower friction surface **157***b* are provided to face each other while having a gap therebetween spaced enough to allow the shaft **140** to passed therethrough. That is, the gap may have a size larger than a diameter of the shaft **140**.

In the first state, that is, when the knock-up plate **120** is caused to come into close contact with the feed tray **110** by the rotating lever **150**, the shaft **140** makes contact with the lower friction surface **157***b* of the rotating lever **150** due to a force of the rotating lever **150** pushing the knock-up plate **120** toward the feed tray **110**.

In the second state, that is, when the knock-up plate **120** is spaced apart from the feed tray **110**, a force pushing the knock-up plate **120** toward the feed tray **110** does not act, so

that the shaft **140** makes contact with the upper friction surface **157***a* of the rotating lever **150**.

Accordingly, the lever rotating part **156**, upon the second state of the knock-up plate **120**, is subject to a weak rotation frictional force when compared to upon the first state of the knock-up plate **120**, and in this state, the lever rotating part **156** is prevented from rotating beyond a predetermined angle due to the deadweights of the lever elastic member **170** and the rotating lever **150**.

In addition, when the holding protrusion **154** of the rotating lever **150** is spaced apart from the locking protrusion **124** of the knock-up plate **120** according to rotation of the pickup roller **130**, the rotating lever **150** performs a liner movement along the hollow part **158** of the lever rotating part **156** to prevent the knock-up plate **120** from being interfered by the rotating lever **150**. That is, as the rotating lever **150** moves in direction A, the interference of knock-up plate **120** by the rotating lever **150** is more effectively prevented.

The rotating lever **150** may further include a depression part **161**. The depression part **161** is formed on a lateral side of the lever body **152** extending in an elongated shape. In detail, the depression part **161** may be provided between the lever rotating part **156** and the holding protrusion **154**.

When the knock-up plate **120** is spaced apart from the feed tray **110**, the end portion of the knock-up plate **120** makes contact with the rotating lever **150** while being interfered with each other. In order to prevent such interference, the depression part **161** is formed by depressing a portion of the lever body **152** between the lever rotating part **156** and the holding protrusion **154**. As the plate lifting part **120***b* is disposed on the depression part **161**, the plate the knock-up plate **120** is prevented from being restricted by the holding protrusion **154** of the rotating lever **150** during operation of the pickup roller **130**.

The rotating lever **150** may further include a mounting protrusion **162**. The rotating lever **150** is pressed toward the knock-up plate **120** by the lever elastic member **170**. The mounting protrusion **162** protrudes from the rotating lever **150** such that one end of the lever elastic member **170** mounts to the mounting protrusion **162**.

The mounting protrusion **162** is provided at the opposite side of the holding protrusion **154** on the lever body **152**. The mounting protrusion **162** protrudes from the lever body **152** while bent and extending in a direction opposite to the lever rotating part **156**.

Hereinafter, an operation of the printing medium supplying apparatus **100** according to an embodiment of the present application and an image forming apparatus having the same will be described.

The feed tray **110** is provided on the body **10** so as to be rotated between the first position P1 in which the feed tray **110** is folded to one surface of the body **10** while forming an external appearance of the body **10** and the second position P2 in which the feed tray **110** is open such that the printing medium S is loaded on the feed tray **110**.

FIG. **6** illustrates an operation of the feed tray **110** in the first position P1 in which the knock-up plate **120** is caused to come into close contact with the supply tray **110** by the internal configuration of the body **10**. In this state, the knock-up plate **120** is not directly restricted by the rotating lever **150**, but when the feed tray **110** converts from the first position P1 to the second position P2, the knock-up plate **120** is restricted by the restriction surface **154***a* while moving along the lever body **152**.

FIG. **7** illustrates an operation of the feed tray **110** converting from the first position P1 to the second position P2.

When the feed tray **110** is placed on the second position P2, the knock-up plate **120** is restricted by the holding protrusion **154** of the rotating lever **150** and thus comes into close contact with the feed tray **110**. That is, the rotating lever **150** is pressed toward the knock-up plate **120** by the lever elastic member **170**, and in this case, the holding protrusion **154** of the rotating lever **140** restricts the locking protrusion **124** of the knock-up plate **120**, thereby allowing the knock-up plate **120** to come into close contact with the feed tray **110**.

According to the present embodiment, the knock-up plate **120** is restricted by the rotating lever **150** while the feed tray **110** is being converted from the first position P1 to the second position P2. However, according to another embodiment, the knock-up plate **120** may be restricted as the knock-up plate **120** is directly pressed toward the feed tray **110** when the feed tray **110** is placed in the second position P2.

FIG. **8** illustrates the pickup roller **130** that operates such that the printing medium is supplied.

When the pickup roller **130** operates, the lever rotating part **156** receives a frictional force according to rotation of the shaft **140**. The lever rotating part **156** performs a circular movement according to rotation of the shaft **140**, or performs a linear movement at the hollow part **158** as the restriction on the holding protrusion **154** by the locking protrusion **124** is released.

In this process, the rotating lever **150** is spaced apart from the knock-up plate **120**, and the knock-up plate **120** is raised by the plate elastic member **122** provided between the knock-up plate **120** and the feed tray **110**, so that the printing medium is pressed toward the pickup roller **130**.

According to an embodiment of the present application, the knock-up plate **120** is applied to the feed tray **110**, so that the printing medium is easily pressed toward the pickup roller **130**, and there is no need of an operation of additionally pressing the knock-up plate **120** or keeping the knock-up plate **120** pressed in order to supply the printing medium to the feed tray **110**. In addition, the knock-up plate **120** operates in linkage with operation of the feed tray **110**, thereby providing user's convenience. In addition, the restriction of the knock-up plate **120** is released according to an operation of the pickup roller **130**, thereby enhancing the efficiency in supplying the printing medium.

Although a few embodiments of the present disclosure have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. An image forming apparatus comprising:

a body;

a feed tray configured to rotate between a first position in which the feed tray forms an external appearance of the body and a second position in which a printing medium is loaded;

a knock-up plate provided on the feed tray configured to ascend and descend;

a pickup roller configured to pick up the loaded printing medium; and

a rotating lever including a holding protrusion to restrict ascending of the knock-up plate when the feed tray rotates from the first position to the second position.

2. The image forming apparatus of claim **1**, wherein the pickup roller is coupled to a shaft, and wherein the rotating lever releases the restriction of the knock-up plate by rotation of the pickup roller and the shaft at the same time when the pickup roller picks up the printing medium.

3. The image forming apparatus of claim 1, wherein the rotating lever includes a lever body and the holding protrusion includes a restriction surface that is bent from the lever body to make contact with the knock-up plate to restrict an ascending side of the knock-up plate.

4. The image forming apparatus of claim 3, wherein the holding protrusion includes a guide inclination surface that protrudes so as to be inclined with respect to a length direction extending from a rotating center of the lever body such that the knock-up plate is restricted by the restriction surface.

5. The image forming apparatus of claim 1, wherein the knock-up plate is provided on a downstream side in a feeding direction of the printing medium on the feed tray.

6. The image forming apparatus of claim 1, wherein the knock-up plate includes:

a plate rotating part provided on an upstream side in a feeding direction of the printing medium and allowing the knock-up plate to be rotated; and

a plate lifting part provided on a downstream side in a feeding direction of the printing medium and configured to ascend and descend.

7. The image forming apparatus of claim 6, wherein the knock-up plate further includes a locking protrusion that protrudes from the plate lifting part so as to be restricted by the rotating lever.

8. The image forming apparatus of claim 1, wherein:

the rotating lever includes a lever body; and

the image forming apparatus further comprises a lever elastic member configured to press the lever body toward the knock-up plate.

9. The image forming apparatus of claim 8, wherein the rotating lever further includes a mounting protrusion to mount one end of the lever elastic member pressing the lever body thereon.

10. The image forming apparatus of claim 1, wherein:

the rotating lever includes a lever body; and

the rotating lever further comprises a lever rotating part provided at an end portion of the lever body to rotate the lever body and configured to operate with rotation of the pickup roller.

11. The image forming apparatus of claim 10, further comprising:

a shaft coupled to the pickup roller,

wherein the lever rotating part is provided with an elliptical hollow part allowing the shaft to pass therethrough.

12. The image forming apparatus of claim 11, wherein:

the lever rotating part includes an inner surface forming the elliptical hollow part, and

the rotating lever is rotated by friction made between the inner surface of the lever rotating part and an outer surface of the shaft.

13. The image forming apparatus of claim 12, wherein the elliptical hollow part is provided in an elliptical shape such that the rotating lever moves in a direction perpendicular to a lengthwise direction of the shaft.

14. The image forming apparatus of claim 11, wherein the shaft includes:

a first section to which the pickup roller is coupled and which is passed by the printing medium; and

second sections which are provided at both sides of the first section and on which the rotating lever is disposed.

15. The image forming apparatus of claim 14, wherein the second sections are provided with a plurality of protrusions formed along a circumference of the shaft to increase friction with the inner surface of the lever rotating part.

16. A printing medium supplying apparatus comprising:

a feed tray on which a printing medium is loaded;

a pickup roller configured to pick up the loaded printing medium;

a knock-up plate provided on the feed tray so as to ascend and descend to allow the printing medium to make contact with the pickup roller; and

a rotating lever configured to allow the knock-up plate to be restricted at a side of the feed tray, the rotating lever configured to release the restriction of the knock plate by being spaced apart from the knock-up plate when the pickup roller picks up the printing medium.

17. The printing medium supplying apparatus of claim 16, wherein the rotating lever includes:

a lever body provided in an elongated shape;

a lever rotating part provided at an end portion of the lever body and configured to operate with rotation of the pickup roller such that the lever body is moved; and

a holding protrusion which protrudes from the lever body to press the knock-up plate toward the feed tray.

18. The printing medium supplying apparatus of claim 16, further comprising a lever elastic member configured to press the rotating lever toward the knock-up plate.

19. The printing medium supplying apparatus of claim 18, wherein if a force applied to the rotating lever by the lever elastic member is a first pressing force F1 and a force applied to the rotating lever in linkage with rotation of the pickup roller is a second pressing force F2, and the second pressing force F2 is greater than the first pressing force F1 when the pickup roller operates.

20. The printing medium supplying apparatus of claim 16, wherein:

the knock-up plate includes a first state in which the knock plate descends to make contact with the feed tray, and a second state in which the knock-up plate ascends to be spaced apart from the feed tray, and

the knock-up plate operates from the first state to the second as the rotating lever is spaced apart from the knock-up plate due to rotation of the pickup roller.

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